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ABSTRACT

The project's purpose was to determine whether attention to the task during testing was a confounding variable in measures of visual perception ability. Samples of 30 perceptually handicapped (PH) and 30 normal subjects (N) were randomly selected from children so classified on the Frostig DTVP, providing they had IQ scores between 85 and 115 on the Peabody Picture Vocabulary Test. The two samples were further stratified on sex and race. A test of visual memory for letter-like forms was administered to both samples in two presentations, one a group paper-and-pencil test and the other a machine presentation which provided reinforcements for correct responses. An "X Design" controlled for practice effect between the two presentations. Analysis of covariance was performed co-varying the visual memory and IQ scores for both presentations. No significant differences in performance were found on either presentation of the visual memory tests, between the PH and N groups, between the sexes, or in the interaction of perception ability and sex. There was insufficient evidence to conclude that attention to the task was an important variable in perception testing. However, the use of DTVP in testing perceptual ability was found to be highly questionable. For related documents, see TM 002 117, 118.)

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Final Report

Project No. 1G026
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8001 Natural Bridge Road
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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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ABSTRACT

The project's purpose was to determine whether attention to the task during testing was a confounding variable in measures of visual perception ability. Samples of 30 perceptually handicapped (PH) and 30 normal (N) subjects were randomly selected from children so classified on the Frostig DTVP, providing they had IQ scores between 85 and 115 on the Peabody Picture Vocabulary Test. The two samples were further stratified on sex and race. A test of visual memory for letter-like forms was administered to both samples in two presentations, one a group paper and pencil test and the other a machine presentation which provided reinforcements for correct responses. An "X Design" controlled for practice effect between the two presentations. Analysis of Covariance was performed co-varying the visual memory and IQ scores for both presentations. No significant differences in performance were found on either presentation of the visual memory test between the PH and N groups, between the sexes, or in the interaction of perception ability and sex. There was insufficient evidence to conclude that attention to the task was an important variable in perception testing. However, the use of the DTVP in testing perception ability was found to be highly questionable.

CHAPTER I

INTRODUCTION

In recent years, a growing concern has been evidenced among educators, psychologists, psychiatrists, optometrists, physicians, and parents over children who experience difficulty in learning to read. This concern has led to re-evaluation of basic teaching procedures in the schools and to the establishment of special training programs for children identified as having "learning disabilities," "perceptual handicaps," or "perceptual-motor dysfunctions."

This advent of new training programs to alleviate these "learning disorders" has not been accomplished without a large amount of criticism from certain educators. Their criticism has been directed toward the tests used in ascertaining perceptual handicaps (Cohen, 1969) and the training programs used to correct these disabilities, which have not produeced unequivocal results (Jacobs, et al., 1968, and Cohen, 1969).

Regardless of the lack of positive research evidence to support their position, a growing group of perception specialists, from within and outside of education, continue to stress the testing and training of perceptual and perceptual-motor abilities as the main answer to correcting learning disorders. When children experiencing difficulty in learning to read are administered many of the current perception tests, the typical finding is a deficiency in the perceptual ability tested.

The perception specialists point to these findings as indicative of the need for more concerted efforts to train children in basic perception abilities. The educationalist, however, discounts these tests as being of questionable validity and recommends better programs designed to teach skills in specific competencies related to the learning task (Burnett, 1968 and Cohen, 1969).

As a group, children from the slums of our major cities have been shown to exhibit deficiencies in perceptual skills as they are currently measured (Pasamanick and Knobloch, 1958 and Cohen, 1969). In light of recent efforts to provide better programs for disabled readers and culturally-different children, this study was designed to assess the possibility that perceptual deficits, as currently measured, are deficiencies in attention and are concomitant factors in learning disabilities but not causal ones.

One of the often reported characteristics of very young children, disabled readers, and culturally-different youth is their inability to attend to learning situations for extended periods of time, and their tendency to be easily distracted. At the same time, tests which purport to measure various component processes of visual perception - tests of form constancy, hand-eye coordination, spatial relationships, figure-ground discrimination, etc. - required purposeful attention and concentration for relatively long periods of time.

If children lack sufficient motivation to overcome various debilitating factors that may impinge upon a testing situation, they may well exhibit gross deficiencies in any task presented them. Consequently, remedial training based on these measures may be successful only to the extent that the child has been trained to overcome his attentional deficits.

To illustrate the confusion that can be caused in measuring sub-abilities when attentional factors are not controlled, one needs only to review the research on "Auditory Memory Span," a widely researched topic in educational and psychological studies since the late 1800's. Various investigators have linked deficits in this ability to repeat sequences of digits to reading disability (Saunders, 1931; Rizzo, 1939; Rose, 1958; and Neville, 1967).

Cohen (1959), in a factor analysis of the test results from the original Wechsler standardization population, reported that five distinct factors were identifiable in the measurement of the WISC battery. One of these factors was labeled by Cohen as "Freedom from Distractibility." The "Digit Span" sub-test from the WISC, a test of auditory memory for digits, was found to load exclusively on this distractibility factor.

Sawyer (1967), found such low reliabilities for the "Digit Span" sub-test, that she discarded it from her profile of sub-test prediction of reading disability on the WISC. Rodenborn (1969), found that split-half reliabilities on tests of auditory memory for digits and visual memory for letter sequences were much smaller for first graders, who may tend to have short attention spans, than at the other five grade levels in his study. On a test of auditory memory, coefficients of reliability ranged from .59 for first graders to above .81 at the other five grade levels. The visual memory test produced a reliability of .66 for first graders, while the reliabilities at the other grades were above .81, and fourth graders had a reliability coefficient of .91.

Rodenborn (1969), in a factor analysis of the test results from 180 elementary children on tests often reported to be measuring perceptual processes - auditory memory, visual memory, auditory-visual integration and visual-auditory integration, and oral reading ability, reported that only one factor emerged which accounted for most of the variability in test scores. Possibilities suggested for this factor were general mental ability and attention span.

Thus, there is some evidence that tests of basic perceptual abilities may be measuring an attention to the task factor that makes interpretation of such tests hazardous at best.

Purpose of the Study

The purpose of this study was to investigate the possibility that

perceptual deficits, as currently measured by popular tests of visual perception, are deficiencies in attention and are concomitant factors in learning disabilities but not causal ones. The study was designed to assess the influence of attention to the task in a test of visual memory for letter-like forms, a visual perception task that requires subjects to briefly retain the memory of a form, or sequence of forms, while identifying a matching stimulus from a group containing three similar distractors.

The investigator attempted to control the influence of attention to the task by testing two groups of subjects who had been divided into normal and perceptually handicapped performers on a standardized test of visual perceptual ability. The two groups were tested on a standard presentation of a test of visual memory for letter-like forms, and on an optimal presentation of the same test which utilized a modified teaching machine providing tangible reinforcement.

The expectations of the study were that the normal group of subjects would be significantly superior to the perceptually handicapped ones on the standard, or small group test, but no significant differences in performance would occur on the optimal, machine presentation, of this same test of visual memory.

Hypotheses Tested

To fully explore the importance of attention to the task in the measurement of visual memory for letter-like forms, as sampled in this study, the following hypotheses were stated for testing:

1. There are no significant differences between the mean scores on a test of visual memory for letter-like forms, standard presentation, of the normal and perceptually handicapped subjects, when the subjects' test scores are co-variates with their IQ scores.

2. There are no significant differences between the mean scores of the normal and perceptually handicapped subjects on a test of visual memory for letter-like forms, optimal presentation, when the subjects' scores are co-variates with their IQ scores.

Scope of the Study

This study analyzes the performance of two samples of first grade children on two presentations of a test of visual memory for letter-like forms. The subjects were randomly selected from the first grade population of four elementary schools in Normandy, Missouri. One group of subjects was determined to be normal in visual perception ability on the Frostig Developmental Test of Visual Perception and the second group was determined to be perceptually handicapped on this measure. All subjects were further measured as being of average mental ability, scoring between 85 and 115 IQ, on the Peabody Picture Vocabulary Test, Form A. These two samples were further stratified

to include 15 boys and 15 girls, with the same number of black and white males and black and white females in both groups.

Limitations of the Study

The population of first graders from whom the samples were drawn in this study does not represent a larger population and consequently generalizations from this study to other populations will be exceedingly tenuous. The four selected schools are located in middle to lower-middle class communities which were assumed to have large numbers of children who would be measured as perceptually handicapped on the Frostig.

The two samples of thirty children used in this study are relatively small and different results might be obtained with larger sample numbers. Also, the concept of random selection of samples was slightly damaged in this study since the total number of possible subjects for inclusion in the perceptually handicapped group was only 42. The testing of several thousand first grade children during the screening phase of this study would have provided larger numbers of potential subjects and would have better preserved the concept of random sample selection.

The test of visual memory for letter-like forms, used as a criterion measure, was selected because it appeared to measure most closely the visual perception processes required in learning to read. The results of this study are only as valid as the assumption involved with this constructed test. Other tests of visual perception may be more valid and may produce different results.

The thirty item test of visual memory that was constructed is not overly long and the five to six minutes of administration time involved in presenting this test in the standard presentation may not have been long enough to require the subjects to attend to the task for a sufficient period of time. A longer test might have produced different results.

The optimal test situation was a novel one that was designed to control the attention to the task variable, but other procedures might produce better control of this variable. Also, the use of this novel procedure might have introduced other factors into the testing situation that confounded the obtained results.

The Peabody Picture Vocabulary Test, used as a co-variate to control for the effect of IQ in the study, was selected because it would not be measuring the same type of perception processes as the tests used in the study, but the use of other intelligence tests might have produced different results.

Summary

This chapter has presented an introduction to the study, which in-

cluded a statement of the need for further research into the possible confounding of test results when perception processes are measured without controlling for attention to the task.

Within the limitations of the study, this examination screened the first grade children in four elementary schools on the Frostig Developmental Test of Visual Perception and the Peabody Picture Vocabulary Test and randomly selected two groups of 30 subjects, a perceptually handicapped and a normal group, to examine the influence of attention to the task in perceptual testing. Both groups were given two presentations of a test of visual memory for letter-like forms, with one presentation being a standard or small group one and with the other presentation being an optimal one with a modified teaching machine. The teaching machine was used to present the test and reward subjects for correct responses.

Two main hypotheses were stated for further testing, and Chapter II will present the precise methodology used in testing these hypotheses.

CHAPTER II

METHODS

To test the hypotheses concerning the significance of attention to the task in the measurement of visual perception ability, the following procedures were employed.

Population

Four elementary schools of the Normandy School District, a suburban area of St. Louis, Missouri, were selected to provide the first graders in this study. These schools were chosen because they contained the 300 needed first graders and had enrolled nearly equal numbers of black and white children. Two of these schools were in predominately black communities while two were in mostly white areas.

A total of 290 children were tested in these four schools, which was the complete first grade enrollment except for a small number of children with poor attendance records. This total included 153 black and 137 white children.

Sample Selection

The first step in the sample selection process was a small group administration of the Frostig Developmental Test of Visual Perception (Revised, 1966). This battery of five sub-tests was constructed, and is used widely, to identify children with visual perceptual disabilities in order that specific training programs can be instituted to correct noted difficulties. According to the test construction, the five abilities measured by this instrument are:

I. Eye-Motor Coordination, which samples the ability in drawing continuous lines with a pencil or crayon

II. Figure-Ground, which measures the ability to distinguish a figure from a competing background

III. Constancy of Shape, which involves the ability to recognize geometric figures as a class and distinguish them from similar figures

IV. Position in Space, which measures the ability to discriminate between rotated and reversed figures presented in a series

V. Spatial Relationships, which samples the ability to re-create line forms by connecting dots with straight lines

During the last two weeks of September and first two weeks of October in 1971, two senior students in education, who administered all

tests given in this project, tested the 290 children included in the population. The DTVP was administered to small groups of 6 to 10 children in accordance with manual procedures. Both examiners were trained by the project director in proper administrative methods, and several trial administrations of this test were made before actual project testing. The cooperating schools provided relatively quiet testing rooms apart from the classrooms, and although all testing sessions were not under ideal conditions, the conditions were adequate for valid results and were undoubtably similar to conditions that existed during standardization of the DTVP.

Following the testing of children on the DTVP, all test records were scored by the examiner and rechecked by a secretary trained in scoring procedures. The children's scores on the DTVP were used to screen subjects into a normal (N) pool of subjects, a perceptually handicapped (PH) pool, or children eliminated from consideration as subjects, according to the following criteria:

1. N subjects had total Perceptual Quotients of 100 or above (PQ is defined in terms of constant percentiles for each age group, with a median of 100, an upper quartile of 110, and a lower quartile of 90) with no more than 1 Scale Score for a sub-test below 9 (Scale Scores are ratios of chronological ages to perceptual ages, multiplied by 10).

2. PH subjects had total PQ's below 90 with no more than 2 Scale Scores for sub-tests of 9 or above (3 out of 5 sub-tests had Scale Scores below 9).

3. All children with PQ's of 90 to 99 were eliminated from the pools of potential subjects as were children with Scale Score disparities, as indicated above.

Table 1 presents a summary of the screening process on the DTVP. As can be seen, 106 of the 290 children were eliminated from further consideration as subjects and 122 N and 62 PH subjects remained for further screening on the Peabody Picture Vocabulary Test.

TABLE 1

SUMMARY OF SCREENING RESULTS
ON THE DEVELOPMENTAL TEST OF VISUAL PERCEPTION

	N		N
Eliminated PQ 90 to 99.....	74	Pool of N Subjects	122
Eliminated From PH Group (3 Scale Scores 9+).....	29	Pool of PH Subjects	62
		Total Eliminated	106
Eliminated From N Group (2 Scale Scores Below 9).....	3	Total Tested	290

The Peabody Picture Vocabulary Test is an individually administered measure of an individual's receptive vocabulary ability. In this test, the child must decide which of four pictures depicts a word spoken by the examiner. The items are of increasing difficulty, and after a lower level of success has been established so that credit can be given for easier items not administered, the child is presented more difficult items until his correct responses are at a chance level. While the PPVT is not a full range measure of intelligence, there is sufficient evidence that it is a useful measure of academic potential. An additional advantage of the PPVT in this study is that most other IQ tests for young children are heavily weighted with performance-type tasks that are somewhat similar to sub-tests on the DTVP. Thus, the PPVT provides a measure of learning potential that is arrived at in a completely different manner than the PQ scores on the DTVP.

The PPVT was administered individually to 181 of the 184 children by the same two student examiners, who had been instructed on test procedures and had administered several trial tests for practice. Three subjects who were in the pool of normal subjects were not tested on the PPVT due to extensive illness or moving. In keeping with pre-determined criteria, all subjects with IQ scores below 85 or above 115 on the PPVT were eliminated from the two pools of subjects. Table 2 portrays the loss from screening that occurred on the results of the PPVT. As can be seen, 20 children in the PH group were eliminated because their measured IQ was below 85. The N group lost 9 subjects due to low IQ and 16 subjects because their measured IQ was above 115.

TABLE 2

SUMMARY OF SCREENING RESULTS
ON THE PEABODY PICTURE VOCABULARY TEST

	PH	N	Total
Subjects To Be Tested	62	122	184
Eliminated IQ Above 115	0	16	16
Eliminated IQ Below 85	20	9	29
Lost For Other Causes	0	3	3
Total Of Lost Subjects	20	28	48
Total Children Remaining	42	94	136

Since there were two known sources of possible error, sex and race, in the comparison of children labeled perceptually handicapped and normal, the two samples of children were stratified on these characteristics. Table 3 presents the breakdown of the two pools of potential subjects by race and sex.

TABLE 3

AVAILABLE SUBJECTS BY RACE AND SEX
IN THE PERCEPTUALLY HANDICAPPED AND NORMAL GROUPS

	Perceptually Handicapped		Normal	
Sex	Black	White	Black	White
Female	11	4	13	35
Male	12	15	18	28

As can be seen in Table 3, only a total of 15 female subjects remained in the PH group at the stage of sample selection. To allow for analysis of the performance between the two sexes, which is best handled statistically with equal numbers in the sub-groups, all fif-

teen of these children were automatically accepted as S's in the PH group. A table of random numbers was then used to select fifteen boys for the PH group from the 12 Black and 15 White candidates. This resulted in 7 Black and 8 White boys being chosen. A table of random numbers was then used to select Normal subjects to match exactly the race and sex of the sample in the PH group. Table 4 depicts the sex and race characteristics of both the PH and N groups following sample selection.

TABLE 4

THE SEX AND RACE CHARACTERISTICS
OF BOTH THE PERCEPTUALLY HANDICAPPED AND NORMAL GROUPS

	Number of Black Subjects	Number of White Subjects	Total by Sex
Female	11	4	15
Male	7	8	15
Total	18	12	30

Main Testing Procedures

To test the hypotheses concerned with the influence of attention to the task in perceptual testing, a 30 item test of visual memory for letter-like forms was constructed. The test required S's to briefly remember the exact details, orientation, and sequence of letter-forms constructed of lines, angles, and curves, and to discriminate this form from a group of four similar ones. The first ten test itmes required discrimination on the basis of small details, similar to the ability required in discriminating the letters "c" and "e" or "E" and "F". The second 10 items required discrimination on the bais of orientation, similar to the reading task of seeing differences among the letters "d", "b", "p", and "q". The final 10 items required discrimination on the basis of both orientation and sequence, similar to identifying the differences among these letter combinations: "on", "uo", "ou", and "no". Appendix A contains the 30 test items with the stimulus that had to be matched being underlined.

These same thirty items were presented to the 60 subjects in the study in two different procedures. One of these test procedures, called the Standard (S) test, was a small group presentation of test

items. The examiner presented the stimulus for the item on an 11" x 14" piece of white cardboard for approximately one second. The children, who were seated around a table facing the examiner, looked at the stimulus and then attempted to find the exact match for the presented standard on their answer sheets. The children then marked an X on the item they thought matched the standard. To help the children keep their place on the answer sheet, they were instructed to use a marker which was continually moved down the page by the subjects. A copy of the actual answer sheet employed is the display of test items in Appendix A, and Figure 1 is an illustration of how this test was administered.

Figure 1

All sixty subjects were also tested on an Optimal (O) presentation of the 30 test items which employed an adapted MSTA 400 Scholar (Behavioral Controls, Inc. of Milwaukee). The machine presentation of the test followed this procedure:

1. The standard was presented in the top window of the machine for one second. The stimulus was drawn in black ink on white paper and was clearly visible through a clear plexiglass cover.

2. The machine automatically advanced to a four choice situation with the standard covered. The child chose one of the four stimuli as the exact match to the standard and pressed the clear plexiglass key that covered the stimulus.

3. If the child's choice was correct, a reinforcement occurred. A light on a token dispenser lighted, a buzzer buzzed, and

a penney dropped into a visible well. This reinforcement lasted for two seconds, at which time the machine advanced to the next test item.

4. If the child's response was incorrect, nothing occurred for two seconds until the machine advanced to the next item. After an incorrect response, the machine was locked and pushing other keys would not provide reinforcements.

In the testing situation, the subjects were individually brought into the test room and were instructed on a five item sample program. In three cases where the instructions were not clear after five items, the samples were repeated. The examiner remained in the test room and recorded responses, but she was seated out of the child's sight.

The machine was placed on the floor, and the child either sat or kneeled on a covered foam pad. This allowed the subjects to get close to the machine and was more informal than having them seated on a chair at the machine. Figure 2 contains an illustration of the machine and its operation.

Figure 2

In order to control for practice effect between the two methods of presenting the test, an X design was employed in which half of both groups were tested first in the Standard presentation while half of both groups were tested first in the Optimal presentation. In all

cases, the subjects were tested on both presentations on the same day, or on successive days.

To control for examiner bias during the testings, only the project director knew which children belonged to the perceptually handicapped or normal groups. The two examiners took mixed groups of subjects from the classrooms and made their choice of children to be tested on a day on the basis of whether the machine presentation was to be given first or later.

Statistical Analyses

From the results of both presentations of the test of visual memory for letter-like forms, coefficients of reliability were computed using the Spearman-Brown modified formula for comparison of scores on the odd and even test items. In this procedure, a coefficient of correlation is computed between the odd and even test items, which yields a coefficient of reliability for two tests that are one half the length of the original measure. The following Spearman-Brown formula is then used to correct for the actual test length:

$$r_1 = \frac{2\, r_{oe}}{1 + r_{oe}}$$

Where r_1 = the coefficient of reliability of the test
r_{oe} = the coefficient of correlation between odd and even items

To test for significant differences in performance on the two presentations of the test of visual memory for letter-like forms, the program ANOVAR, prepared by G. B. Bone, I.B.M.C., Salt Lake City, Utah, 1970, for use with a 360/65 Computer was employed. This program tests the significance of the difference between two means on some measure while controlling for suspected differences between the groups by co-varying another factor with the reported scores. In this study, the children's scores on the visual memory test and on the Peabody Picture Vocabulary Test were the co-variates.

Summary

This chapter has outlined the specific steps used in sample selection and has explained the test of visual memory for letter-like forms that was constructed and the two modes of presenting this test employed. In addition, the statistical techniques employed in the treatment of the data have been explained to facilitate the presentation of the results of the study in Chapter 3.

CHAPTER 3

RESULTS OF THE STUDY

This chapter presents and discusses in some detail the results of the statistical treatment of the data collected in this study to test two main hypotheses concerned with the effect of attention to the task in perceptual testing. The first part of this chapter covers the reliability data on the two presentations of the test of visual memory for letter-like forms and the last part covers the results of an analysis of co-variance performed to test the hypotheses.

Reliability of the Test of Visual Memory

One approach to estimating the reliability of a test, when alternate forms are not available, is to split the test into two halves of odd and even items. The subjects' scores on these two halves are then correlated and the Spearman-Brown modified formula is used to correct this correlation to an estimate of the reliability for two tests of twice this length. Table 5 reports the coefficients of correlation between the split halves, the coefficients of reliability after correction, and the standard error of measurement for both halves on the standard and optimal presentations of the test of visual memory for letter-like forms.

TABLE 5

CORRELATIONS BETWEEN ODD AND EVEN ITEMS,
COEFFICIENTS OF RELIABILITY, AND STANDARD ERRORS
ON THE TWO PRESENTATIONS OF THE TEST OF VISUAL MEMORY

	Correlation Odd-Even	Coefficients of Reliability	Standard Errors	
			Odd	Even
Standard	.67	.80	2.14	2.21
Optimal	.35	.52	1.96	1.92

As can be seen in Table 5, the correlation of .67 between the odd and even items on the Standard presentation is relatively greater than the .35 correlation on the Optimal presentation. This indicates that the Standard presentation of the test with a .80 estimated reliability was a more reliable measure of visual memory for letter-like forms than was the Optimal presentation with an estimated coefficient of reliability of .52.

While it was not stated directly as a hypothesis, one of the main thoughts behind this study was that the Optimal presentation would increase the subjects' attention to the task, resulting in a more accurate appraisal of individual ability in perceptual tasks, such as tests of visual memory. The evidence available from the reliability data in this study does not support the thesis that a machine presentation of perceptual test items with positive reinforcement will increase attention to the task, or even that such an attention variable is an important factor in perceptual testing.

Analysis of Co-Variance to Test the Hypotheses

An analysis of co-variance was performed on the results of the Standard presentation of the test of visual memory for letter-like forms with the subjects' Peabody Picture Vocabulary scores used as a co-variate to test the study's first hypothesis which was stated:

> "There are no significant differences between the mean scores on a test of visual memory for letter-like forms, standard presentation, of the normal and perceptually handicapped subjects, when the subjects' test scores are co-variates with their IQ scores."

In addition, the possible biasing influence of sex was controlled in the design by comparing the difference in performance between the boys and girls in the total sample and the interaction of sex and perceptual handicap in the subjects' scores. Table 6 presents the results of these analyses.

TABLE 6

TEST OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION IN THE STANDARD PRESENTATION OF THE TEST

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F*
Sex	1	0.1922	0.1922	0.01
Perception	1	0.3432	0.3432	0.03
Sex + Perception	1	6.8500	6.8500	0.51
Within Subgroups	56	744.5089	13.5365	

* F values must be greater than 4.02 to be significant at the .05 level.

As can be seen in Table 6, none of the three sources of variation, sex, perception ability, or the interaction of both, was significant when the subjects' test scores were co-variates with their Peabody Picture Vocabulary scores. Thus, the null hypothesis of no significant difference between the Normal and Perceptual Handicapped groups cannot be rejected from the evidence produced in this study. Also, the subject's sex and the interaction of sex and perception ability produced non-significant differences.

In a similar manner, the results of the optimal test were treated as co-variates with the subjects' IQ scores to test the second hypothesis, which was stated:

> "There are no significant differences between the mean scores of the normal and perceptually handicapped subjects on a test of visual memory for letter-like forms, optimal presentation, when the subjects' scores are co-variates with their IQ scores."

The results of this analysis are presented in Table 7.

TABLE 7

TEST OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION IN THE OPTIMAL PRESENTATION OF THE TEST

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F*
Sex	1	15.5812	15.5812	1.95
Perception	1	2.7300	2.7300	0.34
Sex + Perception	1	2.3367	2.3367	0.29
Within Subgroups	56	439.3999	7.9891	

* F values must be greater than 4.02 to be significant at the .05 level.

As Table 7 shows, all three F ratios were non-significant indicating that the subjects' sex, perception ability, and the interaction of both were non-significant variables in the performance on the Optimal presentation when the subjects' IQ scores were co-variates with the test scores. Thus, in this study, the null hypothesis of no significant difference between the PH and Normal groups could not be rejected.

To determine whether the Optimal presentation had produced signif-

icantly better results than the Standard presentation of the test of visual memory for letter-like forms, an analysis of co-variance was performed on the difference between the Optimal and Standard scores with the IQ as the co-variate with this score difference. Table 8 presents this analysis.

TABLE 8

TEST OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION
ON THE DIFFERENCE BETWEEN
THE OPTIMAL AND STANDARD PRESENTATIONS

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F*
Sex	1	19.2343	19.2343	1.60
Perception	1	1.1372	1.1372	0.09
Sex + Perception	1	1.1851	1.1851	0.10
Within Subgroups	56	662.2463	12.0408	

* F values must be greater than 4.02 to be significant at the .05 level.

As can be seen from Table 8, there was no significant difference in the performances of the subjects, when they were grouped by sex or perception ability or when sex and perception were considered together, on the Standard and Optimal presentations of the test. Thus, the use of positive reinforcement in this study did not significantly improve the performance of subjects on the Standard presentation.

Other Analyses

One of the interpretations that might be made of the finding of no significant differences between the performance of the normal and the perceptually handicapped groups is that the Frostig Developmental Test of Visual Perception was an extremely poor predictor of visual perception ability, as measured. If the Frostig battery were merely acting like an intelligence test, the results obtained in this study would be a likely consequence. This suggestion seemed likely since the mean IQ of the PH group was only 94.3 while the N group had a mean IQ of 100.8. To check this possibility, the data from the study was entered into a correlation program on the 360/15 computer. The program used was the regression program of the "Statistical Package for the Social Studies", Version of 3/13/71. Table 9 presents the correlation matrix generated by this statistical treatment.

TABLE 9

MATRIX OF CORRELATION COEFFICIENTS

		1	2	3	4	5	6	7	8	9
1.	Peabody IQ	1.00	.06	.40	.38	.38	.33	.43	.18	.27
2.	DTVP I		1.00	.35	.14	.24	.27	.56	.20	.03
3.	DTVP II			1.00	.56	.51	.36	.79	.50	.32
4.	DTVP III				1.00	.46	.36	.71	.41	.43
5.	DTVP IV					1.00	.48	.74	.40	.45
6.	DTVP V						1.00	.65	.33	.41
7.	DTVP Total							1.00	.49	.44
8.	Optimal Test								1.00	.57
9.	Standard Test									1.00

Correlations as large as .25 are significant at the .05 level.

Correlations as large as .33 are significant at the .01 level.

As can be seen in the correlation matrix, the Peabody IQ scores and the Total Perceptual Quotient from the DTVP have a correlation of .43 which is significant at the .01 level. While this correlation is not great enough to suggest that the Peabody and DTVP are measuring exactly the same mental process, there is evidence that the two tests are highly correlated and this may be one reason why the nonsignificant differences were obtained in this study.

The relatively low correlations between the Peabody IQ and both the Optimal test scores at .18 and the Standard test scores at .27 were also contributing factors in the obtained results. These low correlations suggest that the Peabody Picture Vocabulary Test was an ineffective co-variate with the test of visual memory for letter-like forms, and another measure of intelligence might have produced different and significant results.

Summary

This chapter has presented the statistical results obtained in this study. Coefficients of correlation were made between the split halves of both presentations of the visual memory for letter-like forms test, and these correlations were corrected by the Spearman-Brown modified formula to obtain coefficients of reliability.

Analysis of co-variance was used to test the two hypotheses in this study with the subjects' Peabody IQ scores and their scores on both the Standard and Optimal presentation of the test of visual memory for letter-like forms as the co-variates. Differences in performance were tested between the two sexes, the two perception classifications, and the interaction between sex and perception ability.

Analysis of co-variance was also used to test the significance of the differences between the Optimal and Standard scores of the subjects.

A matrix of correlation coefficeints was constructed and examined for all of the variables in this study. This examination specifically observed the relationships between the Peabody Picture Vocabulary Test scores and the Total score on the Developmental Test of Visual Perception, the Optimal test scores, and the Standard test scores.

A further discussion of these findings and their implications will be presented in Chapter 4.

CHAPTER 4

CONCLUSIONS

Summary of the Findings

The main findings of the study were:

1. The coefficient of reliability for the Standard presentation of the test of visual memory for letter-like forms was .80, which is much greater than the coefficient of reliability of .52 for the Optimal presentation. This indicates that the Standard presentation was a more reliable measure than was the Optimal presentation.

2. There were no significant differences in performance on the Standard presentation between the sexes, between the two perception groups, or in the interaction of sex and perception ability.

3. There were no significant differences in performance on the Optimal presentation between the sexes, between the two perception groups, or in the interaction of sex and perception ability.

4. There were no significant differences in performance in the difference between the Optimal and Standard presentations between the sexes, between the perception groups, or in the interaction of sex and perception ability.

5. The significant correlation of .43 between Peabody IQ scores and the Frostig Total Perceptual Quotient indicates that these two measures were to an extent measuring the same mental processes. The relatively low correlations between the Peabody IQ and the Optimal presentation (.18) and the Peabody IQ and the Standard presentation (.27) suggests that the Peabody Picture Vocabulary Test may have been a poor measure to use as a co-variate in studies of visual perception ability.

Discussion of the Findings

The findings of this study are largely negative ones due to the inability to reject the first hypothesis, that there was no significant difference between the Normal and Perceptually Handicapped groups on the Standard presentation of the test of visual memory for letter-like forms.

One implication of this finding of no significant difference is that the Frostig DTVP did not differentiate between normal and perceptually handicapped subjects, even when great care was taken to make this distinction between groups certain. While this finding may reflect the weakness of the DTVP in identifying perceptually handicapped children, since the DTVP appeared to be significantly correlated with IQ, it is also highly possible that the small number of

children screened on this instrument (290) did not contain 30 perceptually handicapped children. If this were true, then it would follow that the DTVP would have merely divided the children into high and low IQ groups with a few perceptually handicapped children mixed into the PH group.

Another suggested possibility is that the test of visual memory for letter-like forms was too short of a measure. This 30 item test may not have been of great enough length to permit an attention variable to operate in the study. If this were true, then the distinction between Normal and PH groups found on the DTVP would not be apparent in a short test, especially if attention to the task is an important variable in perceptual testing.

While the Peabody Picture Vocabulary Test was selected for use since it does not measure mental ability with tasks of visual perception, this may have been a poor choice that helped produce the non-significant differences found in the study. The relatively low correlations between IQ and both the Standard presentation (.27) and the Optimal presentation (.18) suggest the possibility that the error in measuring intelligence eliminated significant differences in performance between the groups when the IQ was used as a co-variate with the test scores.

The finding of no significant difference between the Normal and PH groups on the Optimal presentation was an expected result, but this finding was rendered meaningless by the above stated failure to reject the first hypothesis.

Except for the fact that the mean scores of both groups were slightly higher on the Optimal testing, there was little indication from this study that the Optimal procedure was a better method of testing perceptual ability than was the Standard presentation. In fact, the lower coefficient of reliability (.52) for the Optimal presentation indicates that the Standard presentation with a reliability coefficient of .80 was a more stable measure of the test of visual memory.

Implications of the Findings

As has been indicated above, the non-significant findings of this study can not be used to support the contention that attention to the task is an important variable in the measurement of visual perceptual ability. However, the inability to support this hypothesis by evidence gathered in this study does not mean that the attention to the task variable has been proven to be unimportant in perceptual testing. Rather, the findings of this study suggest that further testing of this hypothesis should be made, since a well respected measure of visual perception, the Frostig DTVP, was unable to distinguish between normal and perceptually handicapped subjects when a criterion of visual memory for letter-like forms was used with the subjects' IQ scores as a co-variate.

Further testing of this hypothesis should include these changes in methodology:

1. The screening of larger numbers of children on the DTVP and the use of another test of visual perception to confirm the results of the Frostig DTVP.

2. The use of another intelligence measure, such as the Stanford-Binet or the Slosson Intelligence Test for Children and Adults.

3. The use of a much longer measure of visual memory for letter-like forms. A sixty to eighty item test would probably be most appropriate.

4. A much longer period of acquainting the subjects to the Optimal test procedure prior to the actual testing. From observing the performance of many subjects on the machine presentation, it seemed likely that many subjects were over-anxious in their responses and were compulsively responding without thinking. This may have been due to the novelty of the "game" being played or to the subjects' concern that they might miss a reinforcement if they didn't respond rapidly. In any case an Optimal measure must be truly optimal if the attention to the task variable is to be adequately assessed.

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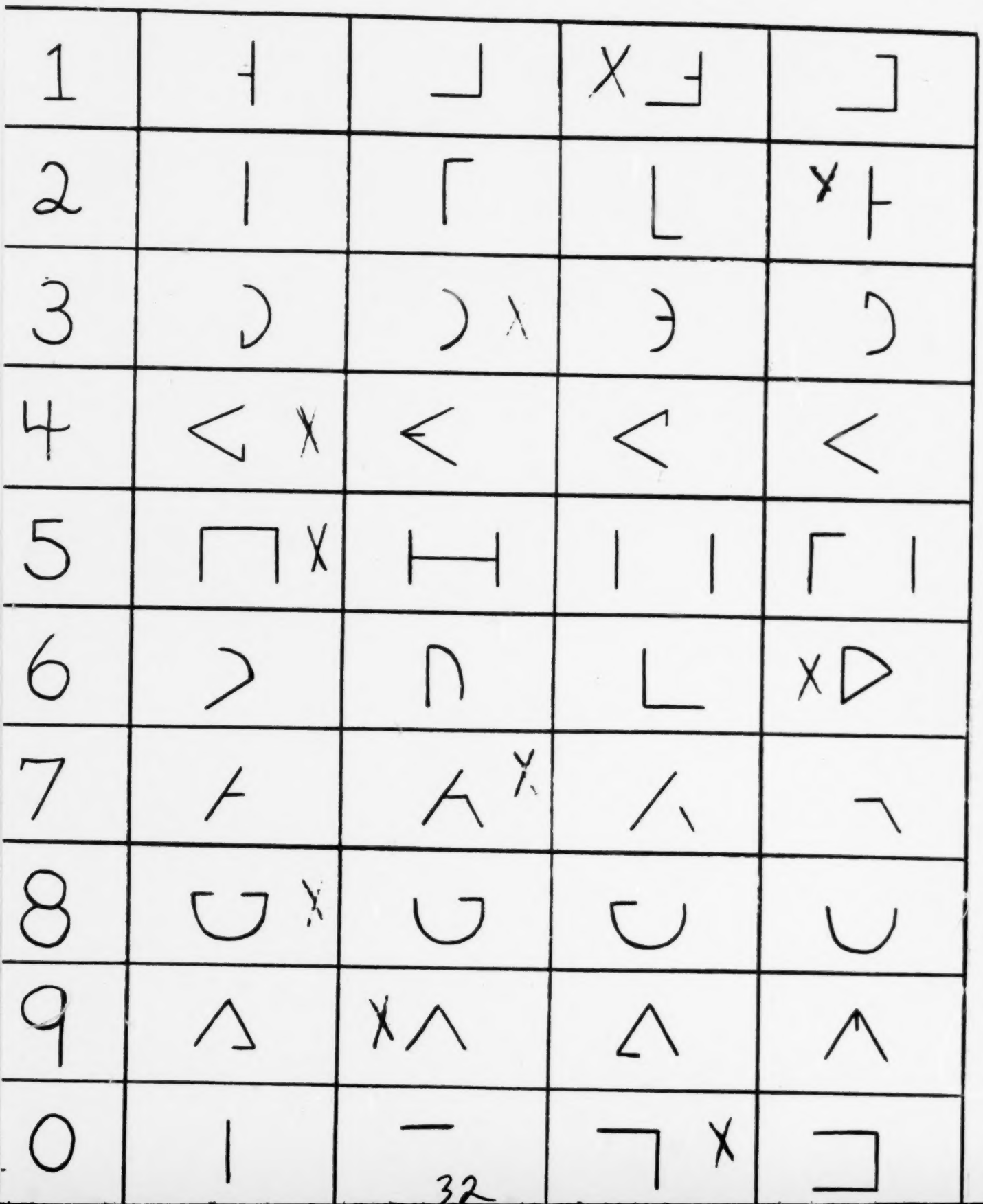
APPENDIX A

THE TEST OF VISUAL MEMORY FOR LETTER-LIKE FORMS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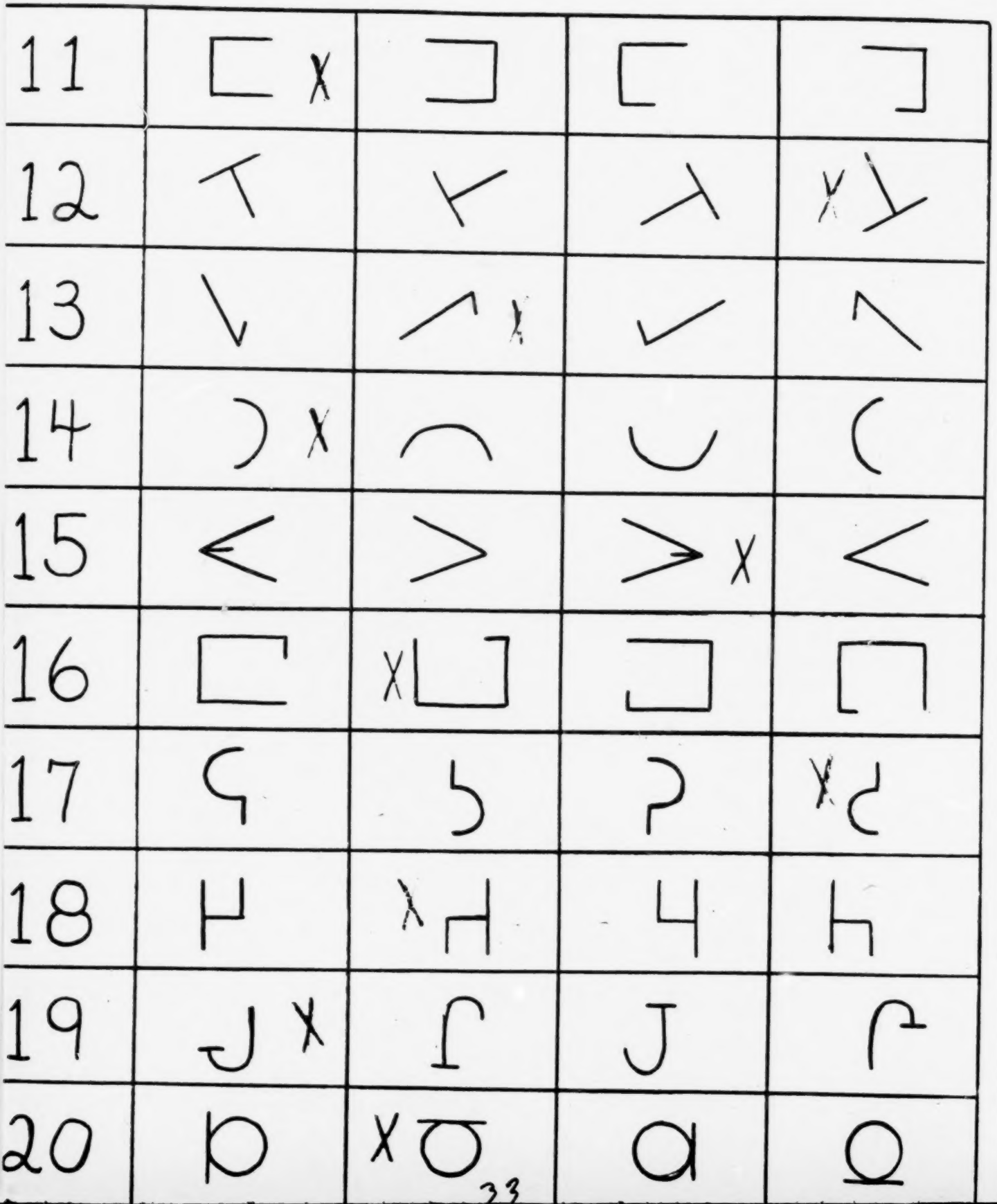
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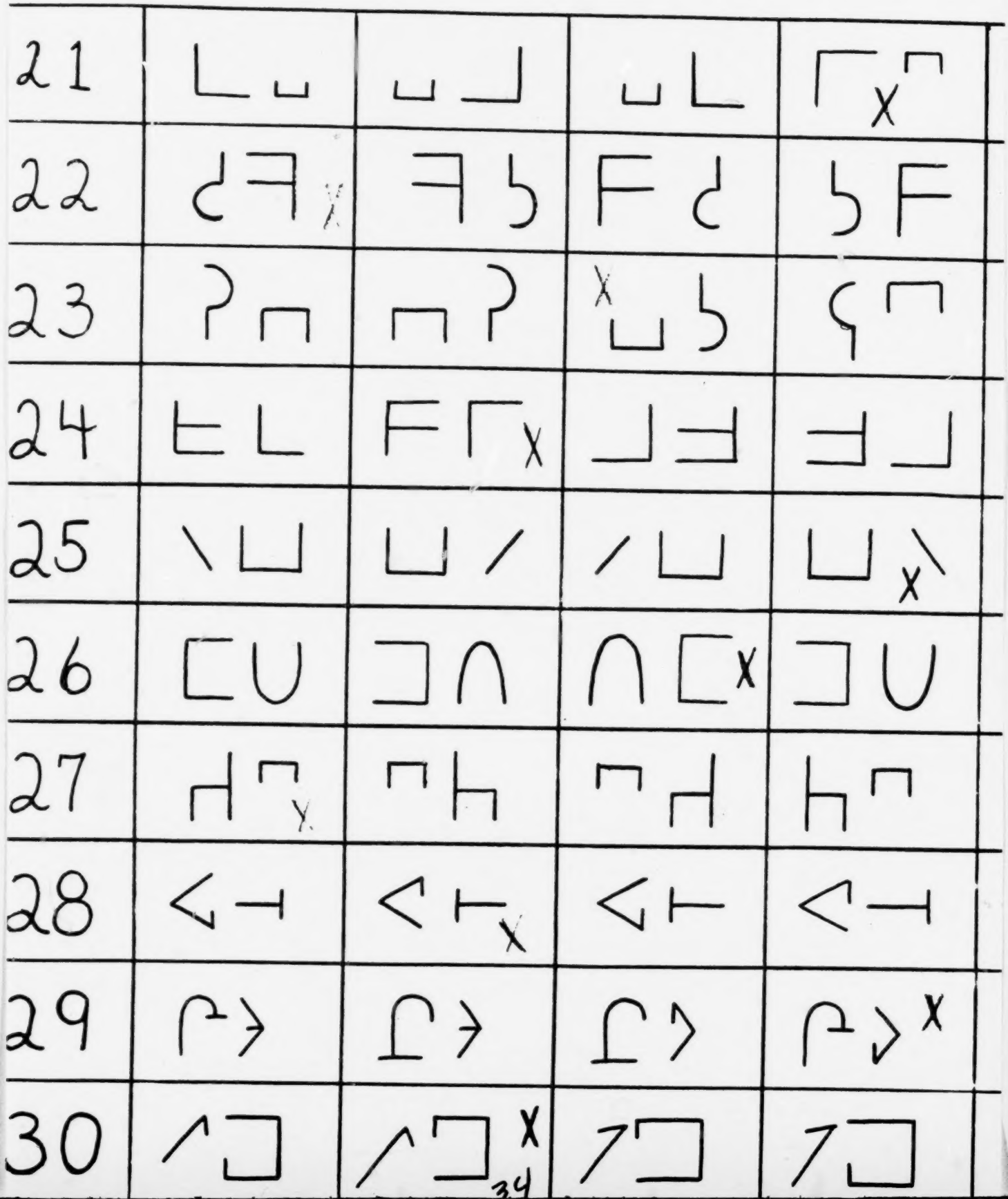

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APPENDIX B

RAW DATA COLLECTED IN THIS STUDY

KEY FOR THE RAW DATA

The following key gives the names of the measures for the column headings in the listed raw data that was collected for the subjects:

1--the child's sex (boys are 1 and girls are 2)

2--the child's race (white is 1 and black is 2)

3--perception rating (PH is 1 and Normal is 2)

4--presentation of tests (Optimal first is 1 and Standard first is 2)

5--chronological age in tenths with the decimal omitted

6--mental age in tenths with the decimal omitted

7--Peabody IQ scores stated

8--DTVP Test I reported in scale score

9--DTVP Test II reported in scale score

10--DTVP Test III reported in scale score

11--DTVP Test IV reported in scale score

12--DTVP Test V reported in scale score

13--DTVP Total Perceptual Quotient

14--Optimal presentation number correct

15--Standard presentation number correct

16--Optimal presentation, number of odd items correct

17--Optimal presentation, number of even items correct

18--Standard presentation, number of odd items correct

19--Standard presentation, number of even items correct

RAW DATA COLLECTED IN THE STUDY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	1	1	1	66	56	085	10	10	08	08	08	087	21	18	10	11	07	11
2	1	1	2	68	68	098	07	07	08	10	11	085	23	21	13	10	10	11
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RAW DATA COLLECTED IN THE STUDY

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